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10/790,213	03/02/2004	Seiichiro Tabata	402993	1012

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EXAMINER	
LIU, LI	

ART UNIT	PAPER NUMBER
2613	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/790,213	TABATA, SEIICHIRO	
	Examiner	Art Unit	
	Li Liu	2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 March 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D: 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-4,6,7,10-12 and 14-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *2-4,6,7,10,12,14 and 16-18* is/are allowed.

6)☒ Claim(s) *11 and 15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Allowable Subject Matter

1. The indicated allowability of claims 11 and 15 is withdrawn in view of the new ground(s) of rejection.

Claim Objections

2. Claim 11 objected to because of the following informalities:

1). The limitation recited on page 6 lines 13-15 is the same as the limitation recited in lines 16-18. The limitation recited in lines 16-18 fails to further limit the subject matter of the claim.

2). The limitation in line 13-15 should be deleted and replaced with the (original) preliminary amended claim 11 line 9-11 because the applicant mistakenly replaced the original limitation "said diffractive element converges the light of the second wavelength from the optical fiber onto said light-detecting section and transmits the light of the first wavelength from said light source" with part of the limitation in original claim 4.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohnishi et al (US 5,555,334) in view of Gal et al (US 5,600,486) and Freeman et al (Freeman et al: "High Efficiency HOEs for Holographic DVD Pickup Heads", IEEE Transactions on Maganetics, Vol. 34, NO. 2, March 1998, page 456-458).

1). With regard to claim 1, Ohnishi et al discloses an optical transmission module (Figure 1) which sends and receives light transmitted bi-directionally through an optical fiber, said optical transmission module comprising:

a light source (1 in Figure 1) which radiates light of a first wavelength (e.g, 1.3 μm);

a light-detecting section (7 in Figure 1) which detects light of a second wavelength (e.g., 1.55 μm) emitted from said optical fiber; and

a diffractive optical element (6 in Figure 1, and Figure 3), which has principal diffractive action of different diffraction orders respectively for the light of the first wavelength and the light of the second wavelength (Figures 3, 8 and 9), wherein said diffractive optical element separates a first optical axis passing from said light source to the optical fiber and a second optical axis passing from said light-detecting section to the optical fiber (Figure 1, because of the diffraction element 6, the optical axis from the fiber 5 to receiving device 7 is separated from the optical axis from light source 1 to fiber 5); and

a lens (lens 3 in Figures 1, 6, 7 and 12-14) which converges and bends light from said light source (light emitting device 1 in Figure 1) toward the optical fiber (the end

face 5 of the fiber 4 in Figure 1) and converges and bends light from the optical fiber toward said light-detecting section (7 in Figure 1), wherein

said diffractive element (6 in Figure 1, and Figures 2-5) converges the light of the second wavelength from the optical fiber onto said light-detecting section (7 in Figure 1) and transmits the light of the first wavelength from said light source (first wavelength (e.g, the first 1.3 μm wavelength is non-diffracted light beam in Figure 8, column 10 line 1-42); or said diffractive optical element (6 in Figure 1, and Figures 2-5) converges and bends the light of the first wavelength from said light source onto the optical fiber and transmits the light of the second wavelength from the optical fiber (although Figures 1 and 8 shows the diffractive grating converges and bends the light of the second wavelength 1.5 μm; it is obvious that by changing the groove depth d, the diffractive grating can be used to converge and bend the light of the first wavelength 1.3 μm because Ohnishi et at teaches: when the groove depth d of the diffraction grating satisfies for a wavelength λ the condition given by $(n_0-n_1)*d = m*\lambda$, where n_0 represents the refractive index of the substrate material forming the diffraction grating, n_1 represents the refractive index of an ambient medium (e.g. air) of the diffraction grating, and m represents a given integer, the diffraction grating behaves for the light beam of the wavelength λ mentioned above as if it had no grooves at all. On the other hand, for the light beam having a wavelength differing from that wavelength λ, the relation given by the above expression does not apply valid even for the same diffraction grating, column 10 line 1-58. Therefore, by changing the groove depth d, the diffractive grating can be used to converge and bend light of different wavelengths).

said diffractive optical element converges one of the light of the first wavelength from said light source onto the optical fiber, and the light of the second wavelength from the optical fiber onto said light-detecting section (the wavelength 1.55 μm is converged to receiving device 7, Figures 1 and 4; and the wavelength 1.3 μm is converged to fiber end 5), and

the light converged has a center that is eccentric from one of a straight line passing from said light source to the optical fiber, and from a straight line passing from the optical fiber to said light-detecting section (the light converged to receiving device has a center that is eccentric from the line passing from light source 1 to the optical fiber 5).

But, Ohnishi et al does not expressly disclose a binary diffractive optical element (DOE) with a **staircase-shaped** diffractive surface.

However, the binary DOE with a staircase-shaped diffractive surface has been widely used as beam splitter, coupler and beam shapers in optical interconnection systems, as well as in scanning system. The binary DOE with a staircase-shaped diffractive surface has a high diffraction efficiency obtained as hologram pattern, and can perform some function that cannot be realized by bulk refractive elements. The binary DOE is relatively easy to manufacture, and present substantial cost savings over conventional precision glass or plastic optical lenses.

Gal et al discloses the advantages of the binary DOE (Figure 3) and uses the binary DOE as the color separator (Figure 2). And Freeman et al also uses the binary

DOE (Figure 2, Multilevel blazed hologram) to diffract the input light to the photodiode so to integrate the laser diode and photodiode in a small compact module (Figure 1).

Because of the advantages of the binary DOE, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the binary DOE as used by Gal et al and Freeman et al to the system of Ohnishi et al so that the system cost can be reduced and the diffraction efficiency can be increased.

3. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohnishi et al (US 5,555,334) and Gal et al (US 5,600,486) and Freeman (Freeman et al: "High Efficiency HOEs for Holographic DVD Pickup Heads", IEEE Transactions on Maganetics, Vol. 34, NO. 2, March 1998, page 456-458) as applied to claim 11 above, and in further view of Yamagata et al (US 6,504,975).

Ohnishi et al and Gal et al and Freeman et al disclose all of the subject matter as applied to claim 15 above. And Ohnishi et al discloses an eccentric converging action (Figure 4 and 5) for converging the light to the detector. But, Ohnishi et al does not expressly state the eccentric non-spherical converging action.

However, another prior art, Yamagata et al, discloses a diffractive optical element having eccentric non-spherical converging action (Figure 15 (B) and Figure 21 (C)).

Yamagata et al teaches that the focal positions of lights with respective orders from the eccentric diffraction lens vary not only in a direction of the optical axis but also in a direction perpendicular to the optical axis. Therefore, the interception by the aperture becomes easy, and the processing accuracy and assembly accuracy of the aperture can be relaxed.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the eccentric non-spherical DOE as taught by Yamagata et al to the system of Ohnishi et al so that the focus position can be conveniently controlled.

Allowable Subject Matter

4. Claims 2-4, 6, 7, 10, 12, 14 and 16-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

5. The following is a statement of reasons for the indication of allowable subject matter: the present invention discloses an optical transmission module having a laser diode, a photodiode, a binary-type DOE lens for 1.3 μm and a binary-type DOE lens for 1.55 μm in a package; by using specific step height and binary steps, at least 5 steps and no more than eight steps, the staircase-shaped DOE lenses have diffraction action of mutually different diffraction orders for light of the two wavelengths: one DOE converges the light of a first wavelength from a light source onto a optical fiber and transmits the light of a second wavelength from the optical fiber, and another DOE converges the light of a second wavelength from the optical fiber onto the light-receiving section and transmits the light of the first wavelength from the light source. The closest prior art, Ohnishi et al (US 5,555,334) shows a similar system. However, Ohnishi et al fails to discloses two staircase-shaped binary diffractive elements that have diffraction action of mutually different diffraction orders for light of the two wavelengths.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Katayama (US 5,696,750) discloses an optical head device with a binary diffractive optical element.

Kim et al (US 6,337,841) discloses a compatible optical pickup using binary staircase diffractive element.

Yagi et al (US 2002/0131175) discloses a diffractive type optical pickup lens.

Komma et al (US 5,446,565) discloses a staircase-shaped binary DOE.

Grossinger et al (US 5,227,915) discloses a binary DOE.

Dammann (Dammann: "Color Separation Grating", Applied Optics, August 1978, Vol. 17, No.15, page 2273- 2279).

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Li Liu whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Li Liu
June 5, 2007

KENNETH VANDERPUYE
SUPERVISORY PATENT EXAMINER